4-10-2010

Impact of Reducing the Latex Content in Latex Modified Concrete

Nicholas Fenton
Indiana University - Purdue University Fort Wayne

Impact of Reducing the Latex Content in Latex Modified Concrete

Nicholas Fenton
Dr. Mohammad Alhassan and Dr. Suleiman Ashur
Department of Engineering/Civil Engineering
Indiana University Purdue University Fort Wayne

Latex Modified Concrete (LMC) is ordinarily used as a thin overlay to shield bridge decks from the intensified application of deicers and environmental elements as well as the normal wear and tear due to traffic. LMC is an ideal concrete for bridge overlays due to its low permeability, inherent flexibility, and excellent bond strength. Another important quality for this concrete that can't be neglected is its lifespan. LMC overlays were originally predicted to endure 20 years of abuse; however overlays constructed in 1974 are still in service today.

LMC is typically composed of coarse and fine aggregate, Portland cement, water, and latex. Currently, the standard is to use 24.5 gallons of latex for every cubic yard of concrete needed. The immediate objective of this research is to study the direct impact of reducing the quantity of latex used in a cubic yard of concrete. The goal being to reduce the initial cost of making the LMC by decreasing the amount of latex without significantly affecting the permeability, strength, shrinkage, and life-cycle cost of the concrete.

In order to study the results of the latex reduction, three mixes of LMC were prepared containing 24.5, 20, and 15 gallons of latex per cubic yard. Each mix was used to make 6"x12" cylinders, 4"x8" cylinders, 6"x6"x 21" beams, and 3.5"x3.5"x11" prisms; which were used to test the performance of each mix in three different areas. The research focused on testing the compressive strength, flexural strength, permeability, and shrinkage of each mix individually. The compressive and flexural strength tests were executed using three 6"x12" cylinders and three 6"x6"x 21" beams; respectively, every 4, 14, and 28 days from the date of mixing. Both of these tests were accomplished using a digitally-controlled Tinius Olsen Universal Testing Machine. The permeability test was conducted after 28 days using three samples sliced from the 4"x8" cylinders. The shrinkage test was conducted for each mix using three 3.5"x3.5"x11" prisms, and was monitored and recorded continuously. All of the tests were conducted according to the applicable American Society of Testing and Materials (ASTM) standards.

The test results showed that the LMC mix with latex content of 20 gallons/yd^3 has comparable performance to the typical LMC mix with 24.5 gallons/yd^3 in terms of compressive and flexural strengths, permeability, and shrinkage. This indicates that the latex cost could be reduced by about 20%. It is important to mention that the latex is an expensive ingredient and its cost may dramatically increase when the oil prices are sky rocketing. Currently the latex cost is around 4$/gallon, however during the high increase the oil prices two years ago, the cost of the latex reached 10$/gallon. Reducing the latex content to 15 gallons/yd^3 is not recommended since the concrete permeability will increase.